Developing GHG Emission Reduction Projects Using AFV Technologies

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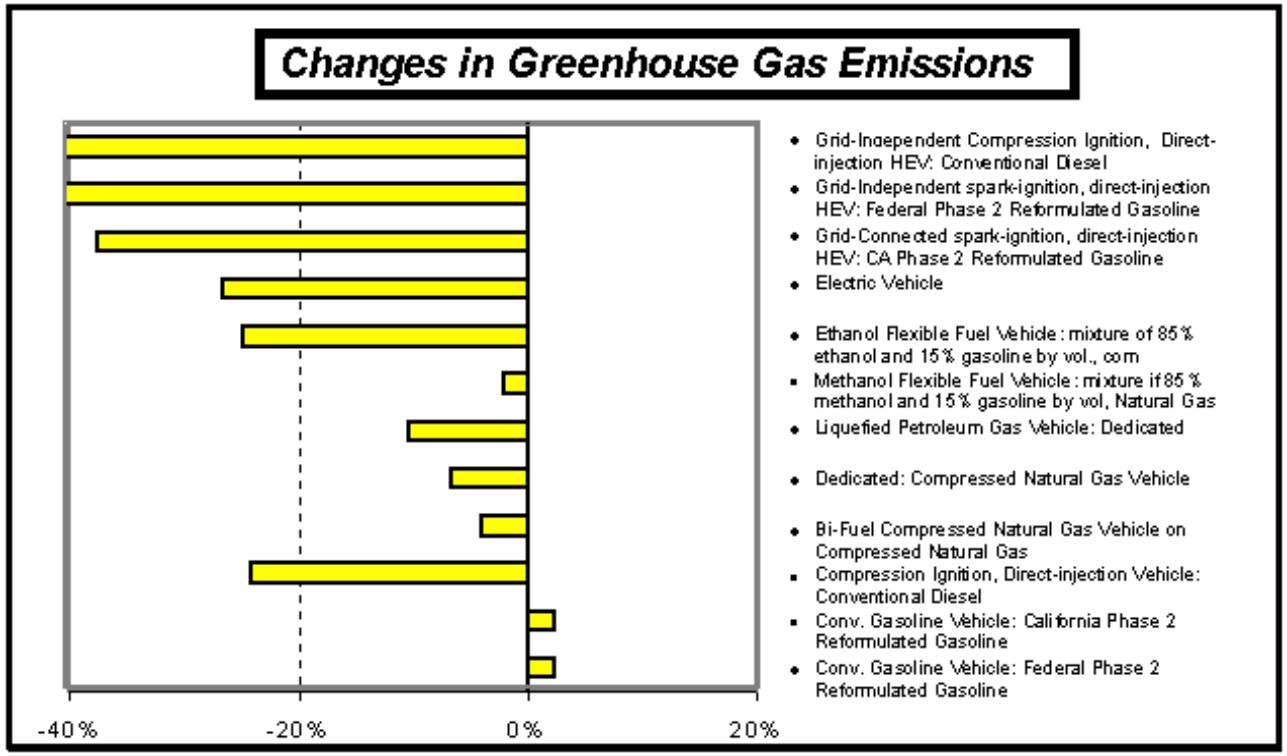
Overview of Session

- Potential GHG Mitigation Activities
- GHG Crediting Considerations
- GHG Emission Baseline Characteristics
  - Environmental additionality
  - Relevant GHGs
  - Project boundary
  - Estimation procedures
  - Available data
  - Baseline types
- Validation, Monitoring, and Verification

Why Get Involved in GHG Projects?

- Significant potential for reducing GHG emissions
- Increase fuel security, reduce urban pollution, improve project financing



Source: Michael Wang, ANL, GREET Model

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Potential GHG Mitigation Activities: Transport Sector

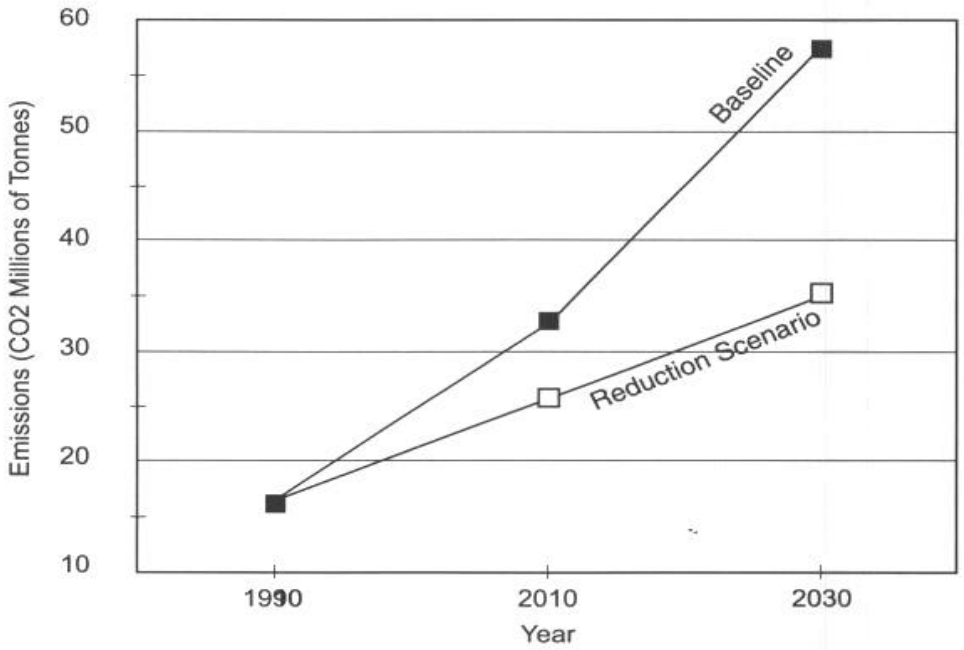
- Improve vehicle fuel efficiency
- Change vehicle and/or fuel type
- Switch transport mode
- Reduce transport activity
- Increase load factor

GHG Crediting Considerations

- Investors prefer low-risk, credible, and permanent GHG credits
- Common elements of existing project-based GHG reduction programs
  - GHG emissions baseline
  - Proof of environmental additionality
  - No leakage outside project boundaries
  - Monitoring and verification plan
  - Certification of legitimate ownership

The Emissions Baseline

- Measure for estimating GHG emission benefits
- Loose baseline procedure encourages free riders
- Conservative baseline increases credibility



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Baseline Characteristics: Environmental Additionality

- Emission reduction credits must be "additional" to business-as-usual
  - Project must lead to actual GHG emission reductions
  - Projects cannot be part of already planned activities
    - Projects resulting from existing government regulations cannot receive credit

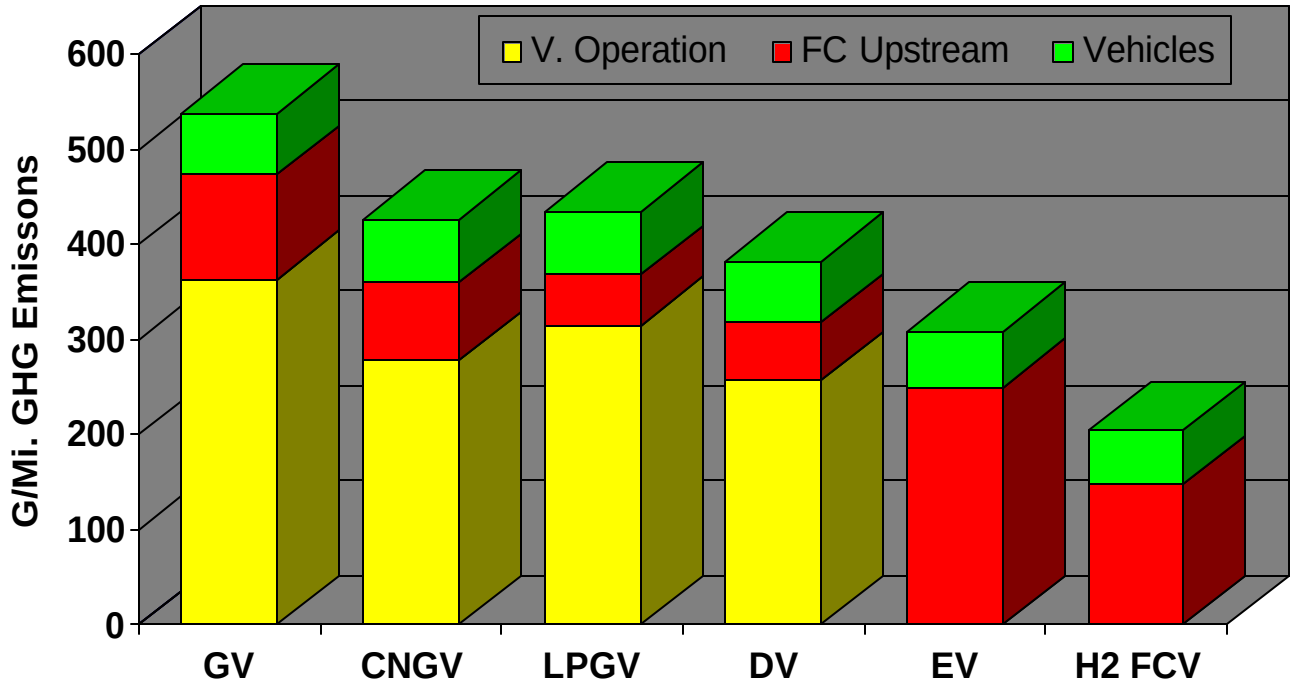
Baseline Characteristics: Relevant GHGs

- All major GHGs must be included in the baseline
- Greenhouse gases from transport activities:
  - Carbon dioxide (CO_2)
  - Methane (CH_4)
  - Nitrous Oxide (N_2O)
- Determine Global Warming Potential (GWP) of GHGs within100 year time frame
  - $CO_2 = 1$; $CH_4 = 21$; $N_2O = 310$
  - Expressed in CO_2-equivalent emissions:

$$CO_2\text{-}equiv = 1 \times (mass\ of\ CO_2) + 21 \times (mass\ of\ CH_4) + 310 \times (mass\ of\ N_2O)$$

Baseline Characteristics: Project Boundary

- Full fuel cycle versus tail pipe emissions analysis
  - Upstream emissions can make a difference when comparing vehicle/fuel systems



Source: Michael Wang, LBNL, GREET Model

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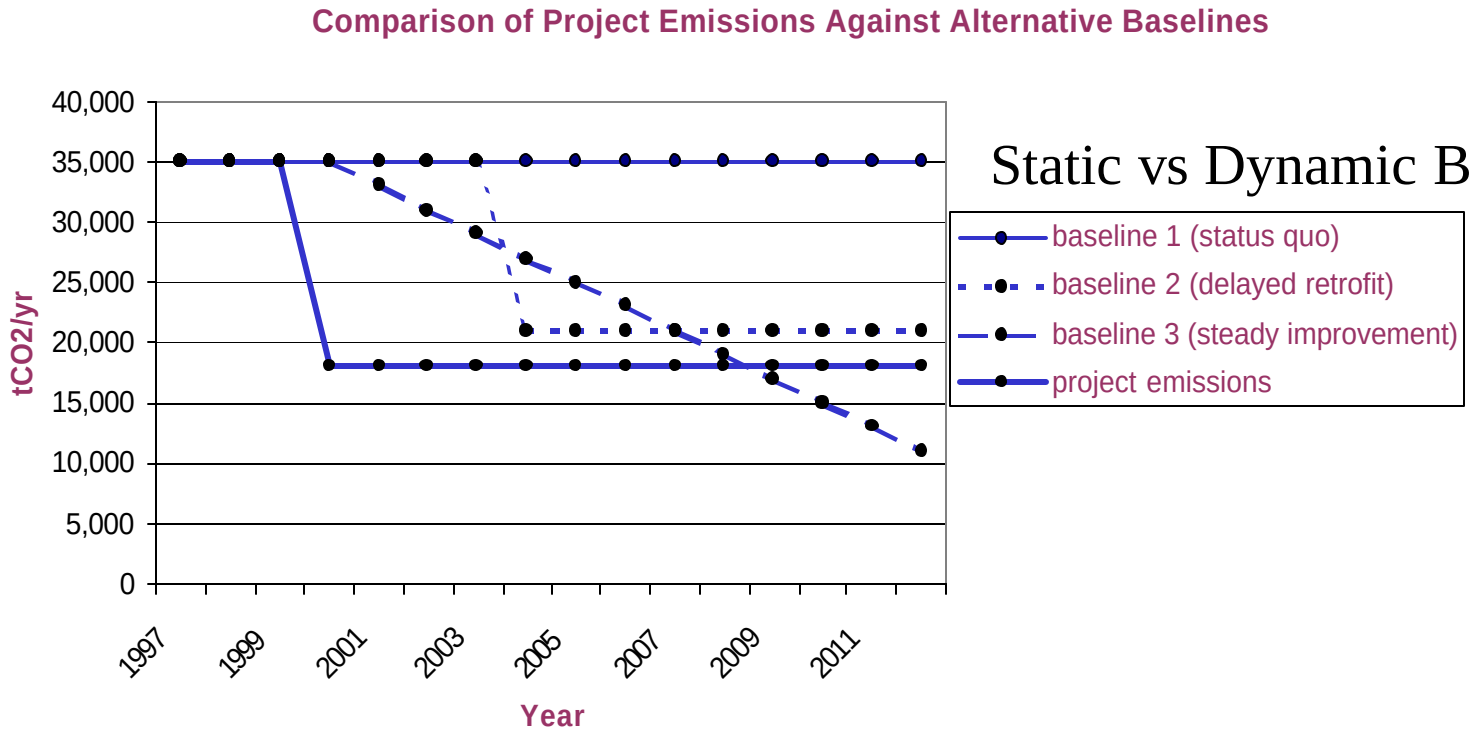
Baseline Characteristics: Possible Estimation Procedures

- Tailpipe evaluation
  - (miles per year) x (grams CO_2-equi per mile)
  - (fuel use) x (fuel CO_2-equi)
  - Most useful for projects with majority of emissions from vehicle operation (CNG projects)
  - Add methane penalty for CNG vehicles, if not calculated directly
- Full fuel cycle evaluation
  - More accurate, but complicated
  - Should be used for EV and hydrogen/fuel cell projects

Baseline Characteristics: Available Data

- For U.S. projects use GREET
  - The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model
  - Argonne National Laboratory www.transportation.anl.gov/ttrdc/greet/
- Other countries
  - Limited data availability
  - One sample transportation project
    - Approved under the UN Framework Convention on Climate Change (UNFCCC) Activities Implemented Jointly (AIJ) Pilot Phase
    - RABA/IKARUS CNG bus project (Hungary)
    - www.unfccc.int/program/aij/aijproject.html

Baseline Characteristics: Sample Types



Static vs Dynamic Baselines

	Baseline 1	***Baseline 2***	***Baseline 3***	***Project Emissions***
cumulative emissions	455,000	329,000	299,000	234,000
total credit	221,000	95,000	65,000	-

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Validation, Monitoring and Verification

- Three basic steps to ensure credibility of credits
  - Third-party *validation* of baseline study
    - Prior to project registration and implementation
  - In-house *monitoring* of emission reductions
    - During life of project
  - Third-party *verification* that monitored emission reductions took place
    - During and/or after life of project

Summary: Project Development Steps